





# ***Applying RCM Principles in the Selection of CBM-Enabling Technologies***



# CBM Transition

## Surface Warfare Vision



- Reduced LCC
- Decreased Maintenance
- Reduced Manning
- 3 Year Deployments
- New Logistics Paradigm

## ACHIEVED WITH BALANCED APPROACH

- CNO maintenance policy
- SHIPMER
- AP-MER
- MRS
- RCM Certification

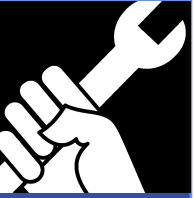
- Wireless, distributed Networks
- "Smart", self-powered Sensors
- Materials / Coatings
- Embedded Training

Policy, Processes  
&  
Procedure

Enabling  
Technologies

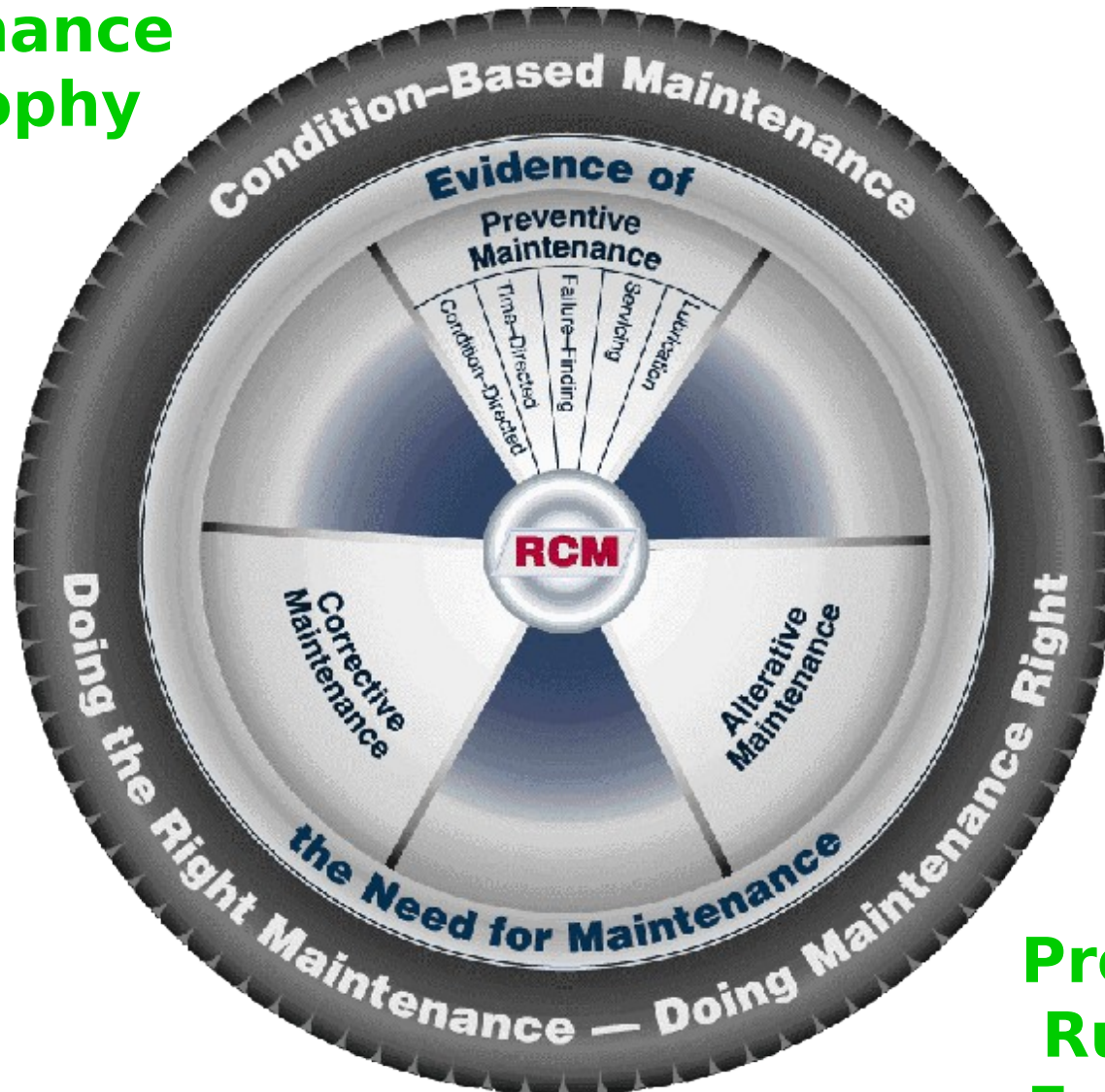
CBM

**CBM - Enabler and Risk Reducer**



# **RCM Is the Hub of CBM**

**CBM is a  
Maintenance  
Philosophy**



**RCM  
Provides  
Rules of  
Evidence**



## ***Proof of RCM Success:***

### **SHIPMER**

#### ■ The process

- Maintenance analysis using RCM principles
- Examines planned, preventive maintenance (PMS)
- Performed by In-Service Engineers (ISEs)
  - ▲ SEA 04RM provides training and logistics support

#### ■ Progress to date

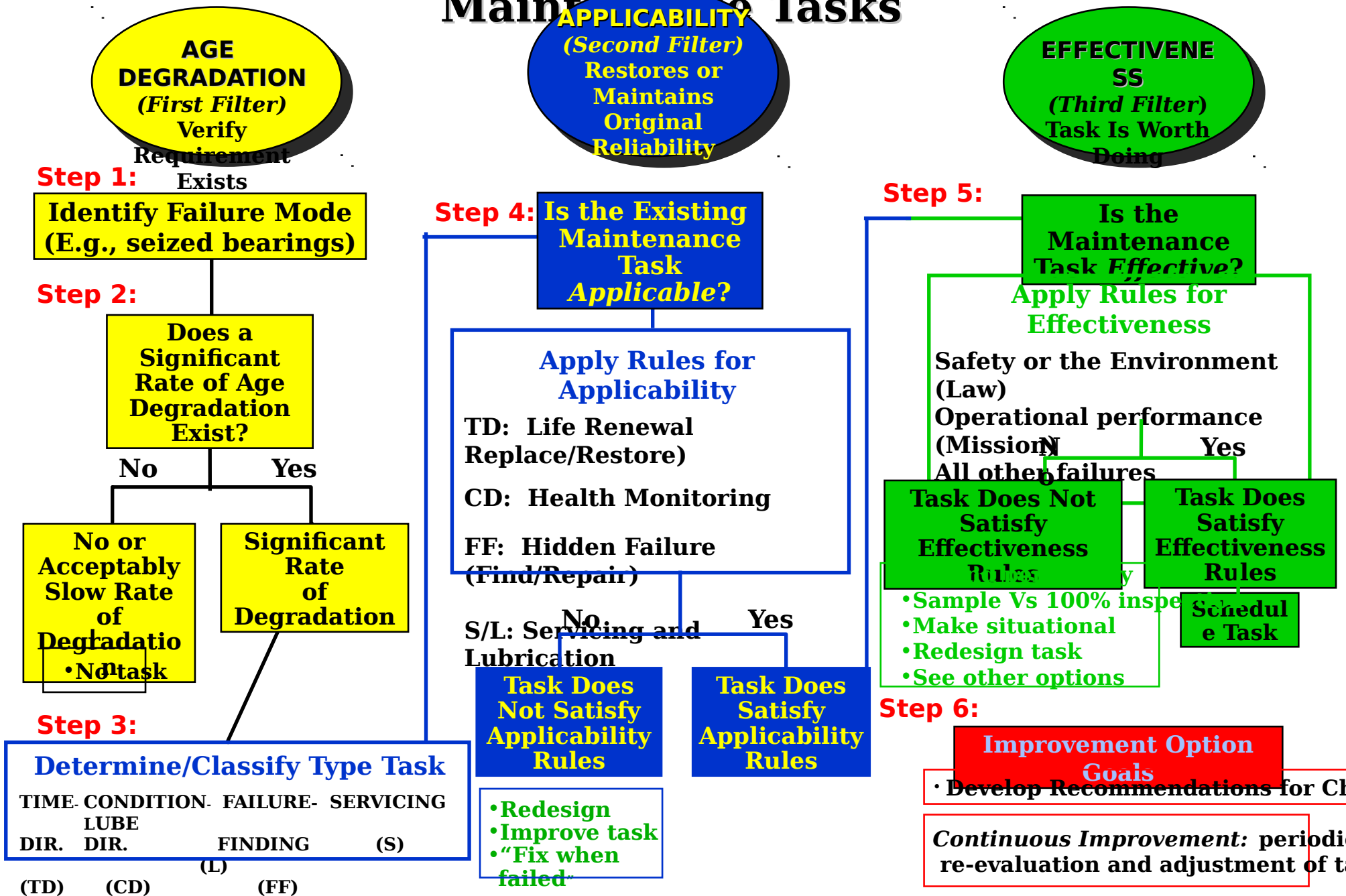
- SHIPMERs 1-54 completed
- Nearly 90% of all O-Level PMS reviewed

#### ■ Documented SURFMER savings

- Exceeded CNO goal of 30% reduction of maintenance manhours

***Achieved nearly 50% reduction as of August 2006***

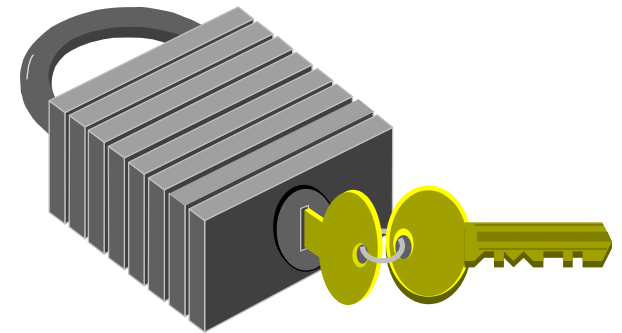
# Road Map for applying CBM to Maintenance Tasks





# Choosing CBM Technology

- Can't afford it all
- Wouldn't all be worthwhile, anyway
- How to choose?
- RCM is the key
  - 1. Determine what maintenance you **need** to do
  - 2. Find CBM technology to support it





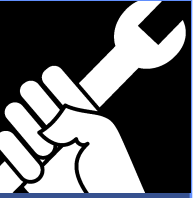
# ***RCM Criteria for CBM-Enabling Technology***

## ■ **Failures Happen: Dominant Failure Modes**

- Failure mode is reasonably likely to occur

## ■ **Applicability**

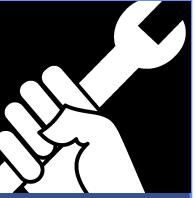
- Monitored parameter really correlates to the failure mode; **and**
- Measures the parameter consistently and accurately; **and**
- Measurements serve as an accurate indicator of required repair action; **and**
- There is adequate time for corrective action before functional failure.



# ***RCM Criteria for CBM-Enabling Technology (cont.)***

## ■ **Effectiveness**

- ***Safety:*** Identifies repair threshold in time to reduce probability of failure to acceptable level; **or**
- ***Mission:*** Identifies repair threshold in time to reduce risk of failure (probability times severity) to acceptable level; **or**
- ***Economics:*** Identifies repair threshold in time to reduce cost to identify and prevent failure at less cost than repairing after run to failure.



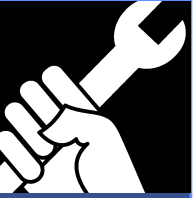
## ***Other Considerations***

### ■ **CBM does not eliminate the need for maintenance**

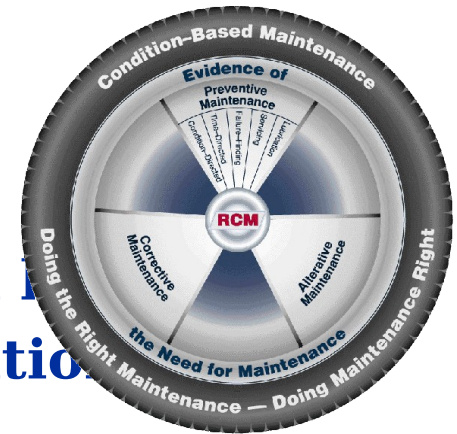
- CBM technology has Ao and maintenance needs
- Deterioration may occur no matter what the maintenance approach
- Goal is to maintain or restore reliability at ***least*** cost
- May allow operator to secure an equipment before occurrence of disruptive and more costly failure

### ■ **Costs considered in determination of effectiveness**

- Hardware and software acquisition
- Development of operating procedures and parametric values vs. deterioration for monitored equipment
- ILS costs, including training



# Conclusions



- **Application of CBM technology can be crucial to a successful CBM transition**
- **But only *worthwhile* technology should be applied**
- **A CBM-enabling technology may be worthwhile only if:**
  - There is a specific failure mode that is reasonably likely to occur
  - The technology can accurately and consistently be used to predict the onset of the failure mode
  - The technology allows operators and maintainers to take appropriate action that reduces probability of failure (safety), risk of failure (mission), or cost of prevention to acceptable levels
  - The technology “pays for itself” in terms of increased Ao or reduced maintenance costs.